April 7, 2008

Notice of Decision

Water Pollution Control Permit
Number Nev0091030

Round Mountain Gold Corporation
Smoky Valley Common Operation

The Nevada Division of Environmental Protection has decided to renew Water Pollution Control Permit NEV0091030 to Round Mountain Gold Corporation. This permit authorizes the construction, operation, and closure of an approved Rapid Infiltration Basin at the Smoky Valley Common Operation in Nye County. The Division has been provided with sufficient information, in accordance with Nevada Administrative Code (NAC) 445A.350 through NAC 445A.447, to assure the Division that the groundwater quality will not be degraded by this operation, and that public safety and health will be protected.

The permit will become effective April 22, 2008. The final determination of the Administrator may be appealed to the State Environmental Commission pursuant to Nevada Revised Statute (NRS) 445A.605 and NAC 445A.407. All requests for appeals must be filed by 5:00 PM, April 17, 2008, on Form 3, with the State Environmental Commission, 901 South Stewart Street, Suite 4001, Carson City, Nevada 89701-5249. For more information, contact Rob Kuczynski, P.E. at (775) 687-9441 or visit the Division's Bureau of Mining Regulation website at www.ndep.nv.gov/bmrr/bmrr01.htm.

One comment letter was received during the public comment period. The letter, dated February 22, 2008 was received electronically from Mr. John Hadder, Staff Chemist, Great Basin Resource Watch (GBRW) and included a technical review by Tom Myers, PhD; Hydrologic Consultant for GBRW. Division responses to Mr. Hadder and Mr. Myers comments are attached to this Notice of Decision.
NDEP acknowledges the assistance provided by Round Mountain Gold Corporation-Smoky Valley Common Operation (RMGC-SVCO) and Water Management Consultants (WMC) in addressing GBRW's concerns.

GBRW Comment #1: "[W]e are not convinced that substandard water (high in arsenic and fluoride) is it not reaching groundwater from beyond the RIB."…"There is not a clear picture of the extent of lateral water movement…that could eventually find a pathway to the groundwater."…"It appears as though there is a high degree of reliance upon the results of Water Management Consultants (WMC) predictive modeling for the RIB."…"The analysis lacks needed data for confirmation, and contains invalid assumptions that call its predictability into serious question."…"GBRW recommends that deficiencies in the model analysis…be addressed promptly to restore public confidence in its use in decision making."

NDEP Response: *Monitoring data collected from the weir discharge and monitoring wells near the RIB demonstrate that RIB discharge is not degrading the waters of the state. Fluoride concentrations at the discharge weir have remained at approximately 8 mg/L since 2005 and arsenic is showing a downward trend, from an average value of about 0.1 mg/L in 2005 to about 0.08 mg/L currently. The most recent (January 2008) observation for arsenic was 0.02 mg/L, the lowest reading in the past 3 years. These data clearly demonstrate that the fluoride concentrations in the RIB discharge are stable, and the arsenic concentrations have been decreasing over the past 3 years.*

Fluoride and arsenic concentrations in groundwater near the RIB are consistent with the WMC 2005, 2006, 2007 modeling results. Furthermore, WPCP NEV0091030 requires monthly monitoring for arsenic and fluoride (as well as several other constituents) and quarterly monitoring for all Profile I constituents. In addition, action levels and limits have been established in the WPCP under Part I.G. Permit Limitations, which state the following:

I.G.2: Arsenic and fluoride threshold concentrations at the Middle Discharge Weir (MDW) are limited to 0.25 and 14 mg/L respectively, based on the most recent (2007) predictive modeling. When monthly monitoring results exceed 0.18 mg/L for arsenic and/or 12 mg/L for fluoride at MDW, the Permittee shall initiate the following actions: 1) notify the Division of the exceedence(s)pursuant to Part II.B.4; 2) perform additional sampling to confirm the analytical results; 3) perform an evaluation and assessment of whether the increasing trend is likely to continue; 4) perform an assessment of the actual dewatering rate and constituent loading of the dewatering water discharged to the RIB system; 5) review monitoring well data to determine any potential downstream influences; 6) update, recalibrate, and re-run the numerical model with the most recent information and data; and 7) on the basis of the evaluation and assessment, prepare and submit a report and action plan (Final Contingency Plan) to the Division within 180 days after the action level exceedence.

I.G.3 When quarterly monitoring results indicate an incremental exceedence of 0.01 mg/L for arsenic and/or 1 mg/L for fluoride at monitoring wells BMW-1, BMW-3, MW-103, MW-104, MW-109, MW-110, MW-111 and MW-112, the Permittee shall initiate the following actions: 1) notify the Division of the exceedence(s)pursuant to Part II.B.4; 2) perform additional sampling to confirm the analytical results; 3) perform an evaluation and assessment of whether the increasing trend is likely to continue; 4) perform an assessment of the actual dewatering rate and constituent loading of the dewatering water discharged to the RIB system; 5) review monitoring well data to determine any potential downstream influences; 6) update, recalibrate, and re-run the numerical model with the most recent information and data; and 7) on the basis of the evaluation and assessment, prepare and submit a report and action plan (Final Contingency Plan) to the Division within 180 days after the action level exceedence.

I.G.4: The overall net annual average discharge rate of dewatering water into the Smoky Valley RIB system shall not exceed 3,400 gpm.

The statement by GBRW that "there is a high degree of reliance [by NDEP] on predictive modeling results" is a matter of opinion. The MODFLOW-SURFACT predictive groundwater model results were useful and beneficial in the establishment of fluoride and arsenic permit baseline limits, however NDEP did not rely entirely on the predictive modeling results as implied by GBRW.

Observed groundwater elevations, water chemistry data from monitoring wells at the RIB site and throughout the conveyance channel corridor, as well as weir flow and chemistry data were used to verify model validity and determine what additional data was needed. Furthermore, compliance has and will continue to be based on actual monitoring data collected from the dewatering wells, weir monitoring locations, groundwater monitoring wells, piezometers and the RIB itself.

GBRW Comment #2: "We recommend that water quality data be obtained from the RIB piezometers to better understand water chemistry…and ideally that lysimeters be installed to determine the extent of lateral water flow"…"The nearest drinking and irrigation wells downgradient should also be monitored."

NDEP Response: *The approved monitoring system adequately monitors groundwater beneath the RIB.*

GBRW Comment #3: "…Round Mountain mine should treat the dewater water to remove the excess arsenic and fluoride prior to discharge into the environment."…"[F]urther data is needed…to further characterize the movement of the discharge water and functioning of the RIB."

NDEP Response: *Any requirement to install arsenic and fluoride treatment systems as well as the need for further characterization and monitoring will be based on NDEP's evaluation of data collected from the dewatering wells, weir monitoring locations, groundwater monitoring wells, piezometers and the RIB itself.*

GBRW Comment #4: "[I]nfiltrating water beneath the RIB is moving northward in the vadose zone."…"This statement [in the Fact Sheet, Page 5] is confusing, misleading, and probably incorrect."…"Based on the lithology…[at] BMW-1…it is possible that lateral unsaturated flow occurs in the vadose zone."…"There is no sampling of this water…and no indication of whether the vadose water may reach the regional groundwater….downgradient of the RIB."

NDEP Response: *Monitoring data does indicate some groundwater flow to the north. It is also likely that there is some flow to the east, toward the cone of depression from the mine. The statement has been rewritten to state that water percolating from the main part of the RIB spreads laterally within the vadose zone and enters the groundwater system beneath the RIB.*

The vadose zone is not defined by the degree of saturation of water in the soil pores; however, saturated soil conditions are possible in the vadose zone and occur from natural and anthropogenic processes. The vadose zone beneath the RIB and above the groundwater table is *variably saturated. Seasonal discharge of water to the RIB is most likely creating minor zones of transient saturation and positive pore pressures. However, as WMC notes, these transient saturated zones can only be maintained briefly by water infiltrating by the RIB.*

As soon as ponded infiltration ceases, these transient saturated zones quickly dissipate. Monitoring well and piezometer data presented in WMC 2005, 2006, and 2007 [predictive groundwater modeling studies], demonstrates that the soil beneath the RIB is a vadose zone.

<u>GBRW Comment #5</u>: "[T]hey [WMC] present no data…to verify the hypothesis [sources of arsenic and fluoride are from the geothermal zones]…there may be other explanations."…"The explanation there are localized 'pockets' of granitic alluvial sediments that contain elevated antimony is feasible but without data, unproven".

<u>NDEP Response</u>: *Arsenic, fluoride and antimony are leached from minerals contained in the bedrock as well as the alluvium derived from it. While hydrological and geological studies have shown arsenic and antimony mineralization within the orebody, the studies have not identified any significant mineralization to indicate potential sources of fluoride. Fluorite is known to occur in veins within the Round Mountain granite which could invariably be a source of fluoride. Sampling of dewatering wells within the pit indicates those wells drawing from the granite pluton have consistently higher fluoride concentrations than wells drawing from the tuffs. Leaching of fluorite from granite clasts present in the basal alluvium has also contributed fluoride to the groundwater downgradient of the granite sub crop.*

Under natural conditions, the flow of groundwater across the ore body would be towards the west northwest. The area of elevated arsenic and fluoride concentrations is slightly offset to the south of the orebody, which is centered on the open pit. Elevated arsenic and fluoride concentrations in this area may indicate the influence of rising thermal waters to the south of the pit, as explained in the WMC 2005 modeling studies.

As WMC points out, temperature data for water samples collected in 2004 from alluvial wells on the west side of the Round Mountain pit also indicate a southwards increasing temperature gradient within the natural groundwater system. There is a general correlation between groundwater temperature, fluoride and arsenic in alluvium. Temperature data are not available for all of the alluvial monitoring wells, however, the dewatering wells form part of a general trend towards increased arsenic and fluoride concentrations southwards along the west side of the pit, reaching a maximum in the area of geothermal monitoring well GMW-1. As the bulk of the water produced from the mine and which ultimately reaches the RIB is pumped from alluvial wells, this is the principal source of arsenic and fluoride in water diverted to the RIB.

<u>GBRW Comment #6</u>: "MW-111 has high concentrations of sulfate, TDS and selenium. The explanation that water infiltrates from natural streams flowing across the playa causes the elevated concentrations cannot be correct. It is generally accepted in the Great Basin that recharge does not occur in the playa zones because the sediments are too fine……Seepage through playas cannot explain the presence of sulfate, TDS, and Se in the groundwater at MW-111".

<u>NDEP Response</u>: *Although the amount of recharge in playa zones is extremely small, there is still potential for surface water to infiltrate. The RIB is located in area with a complex stratigraphy comprised of sand and silt lenses, capable of providing indirect pathways for infiltration of runoff and seasonal precipitation. As WMC points out, drilling logs for monitoring*

wells MW-111 and MW-112 verify the presence of these lenses, rather than thick layers of fine-grained material. The lenses underlying the RIB could potentially provide a means for infiltration on the lower alluvial fans to reach the groundwater beneath the valley floor.

<u>GBRW Comment #7</u>: "The high local concentration at one well suggests a local and recent source. Within alluvium the groundwater flow would tend to disperse sulfate and TDS. In fact, the levels observed at MW-111 would create a significant gradient for diffusion that would cause some dispersion if there is a geologic explanation. In other words, even diffusion would disperse a natural source over millennia. Additionally, if the conductivity values postulated by WMC in the groundwater model are correct, there is so much flow through the system that any contaminants would quickly advect [move laterally] and there would not be much of a long-term concentration peak. Only a new source would create such a localized high point in the alluvium. NDEP should determine the source of these high concentrations."

<u>NDEP Response</u>: *Elevated concentrations of sulfate and TDS observed in MW-111 indicate a localized source. There is sufficient data available to conclude that the source of the elevated constituents (calcium, magnesium, sodium sulfate and chloride) is not from the RIB discharge but the sediments beneath the surface and adjacent to the well. This is further demonstrated by the apparent lack of arsenic, fluoride and base metals present at MW-111.*

WMC's explanation is that soils at surface in the vicinity of MW-111 are characterized as being alkaline to very strongly alkaline with local development of carbonates. This soil environment is consistent with the precipitation of common evaporates such as gypsum, halite and assorted sodium carbonates during periods of prolonged water table decline. These minerals would readily re-enter solution during seasonal or longer term rises in water table elevation.

WMC adds that since paleo-playa layers, evaporite deposits, and ash fall layers are common in Nevada alluvial basins, these often contribute to naturally occurring local variability in the alluvial groundwater concentrations of sulfate, chloride, calcium, magnesium, sodium, and other associated constituents. In addition, lake deposits in the subsurface may contain considerable amounts of evaporate-rich minerals that were concentrated in playas.

Furthermore, Pleistocene-age ash-beds may also provide a source of readily leached alkali and alkali earth metals. Similar concentrations of dissolved alkali and alkali earth metals, sulfate and chloride are encountered in lower alluvial fan and river terrace groundwater elsewhere in northern Nevada (in the Battle Mountain area for example).

<u>GBRW Comment #8</u>: "WMC mentions "a regional model previously developed by WMC" but provides no reference".

<u>NDEP Response</u>: *This comment refers to the 2005 modeling performed by WMC. The regional model mentioned is part of the on-going Round Mountain Expansion EIS model.*

<u>GBRW Comment #9</u>: "It is not clear how the infiltrating water flows vertically though all of the clay present above the gravel layer."…"It is not clear whether it (the model) is confined or unconfined".

<u>NDEP Response</u>: *The shallow groundwater system is a series of clay and sands lenses. The discontinuous clay lenses generate winding vertical flow paths, resulting in some lateral*

spreading and since the lenses are not continuous, they allow some vertical infiltration. In those areas where impermeable clay is present, the infiltrating water will move horizontally along the path of least resistance until it reaches a more permeable material where vertical infiltration can continue. Refer also to NDEP's response to GBRW comments #4 and #6.

WMC ran the MODFLOW-SURFACT model in an unconfined mode with saturated/unsaturated flow (i.e. Richard's equation). Per WMC, both unconfined and confined groundwater systems may be simultaneously simulated in the unconfined mode with MODFLOW-SURFACT. The confined mode is generally only used to simulate confined systems, as confined conditions are only an approximation of unconfined groundwater flow.

<u>GBRW Comment #10</u>: "WMC (2005) indicated that well BMW-1 provided the basis for the lithology of the groundwater model."…"They set horizontal conductivity to alternate among layers at 10 and 1 ft/d for the top eight layers, for 80 ft of the model. Vertical anisotropy was set at 10. These values are extremely high for clay."…"[S]uggest a range for clay from 10^{-7} to 10^{-3} ft/d; because these layers may include other materials, higher conductivity values…may be expected…unreferenced values used by WMC are orders of magnitude too high".

<u>NDEP Response</u>: WMC utilized the alternating layering approach to provide a more realistic and accurate simulation of the infiltration processes which were described previously in NDEP's response to GBRW Comments #4 and #9. Utilizing continuous layers of low permeability material would result in a lateral spreading of the water and in the process form a large mound beneath the ground surface and water pooling above ground surface. Groundwater data verifies that is not occurring at the RIB.

The K (conductivity) values simulated in the WMC models are reasonable average values given the presence of higher-conductivity sands and gravels in the vadose zone, through which most vertical infiltration is occurring.

<u>GBRW Comment #11</u>: "The total flow through the 30-foot layer under the RIB would be 9800 af/y."…"This flow rate is much higher than the amount from the RIB; at its maximum, the rate is 0.0486 ft/d or 610 af/y."

<u>NDEP Response</u>: Flow from the RIB is small when compared to the overall flow through the Big Smoky Valley groundwater system. Big Smoky Valley is a large groundwater system with relatively high groundwater recharge rates and large volumes of water in storage.

<u>GBRW Comment #12</u>: "WMC (2005, 2006) [in the WMC groundwater modeling] used a constant-head boundary at the south and northern end of the model domain which provides an unlimited source of water; the boundary holds the head constant."…"[W]ater level contour maps…show a groundwater divide south of the RIB which would prevent significant flow to the south…a boundary condition which allows an unlimited amount of water to enter is inappropriate".

<u>NDEP Response</u>: WMC utilized constant head boundaries in their groundwater modeling. The heads for each constant boundary cell were based on the water table map shown in Figure 1.1 of WMC 2006 and varied in an effort to replicate the groundwater heads as accurately as possible. A comparison of Figure 1.1 and the simulated water table in Figure 4.1 of WMC 2006 indicated that the groundwater model was in agreement with actual observed groundwater heads in the alluvial groundwater system.

WMC has verified the existence of a flow divide somewhere to the south of the model domain. Initial test runs by WMC were made with the flow divide at the southern model boundary (i.e. "no flow" boundaries specified along the southern edge of the model). By placing a flow divide at the southern model boundary, flow in the southeast quarter of the model is redirected in a southeast direction. Use of the flow divide in place of a constant head boundary, allows for a greater portion of constituents from the RIB to move to the east where they would be captured in perpetuity by the cone of depression created by the Round Mountain Pit. For the purposes of evaluating the potential for constituent migration, and the uncertainty in the location of the flow divide, WMC considered it prudent to assume that some flow does occur to the north through the southern model boundary. Assuming a flow divide at the southern edge of the model would have had the effect of reducing predicted constituent concentrations to the north of the RIB.

GBRW Comment #13: "The original groundwater table had been intercepted at this point [BMW-1], which corresponds to an elevation of 5,674 ft amsl. The recent elevation is 5,719 [ft amsl] indicating the mound is 45 feet."

NDEP Response*: The 5,674 ft amsl groundwater elevation for BMW-1 was reported incorrectly in WMC 2005 and revised in subsequent groundwater models. The original static water level at time of drilling was 5,748 ft amsl. By 1994 the water level in the well had dropped to about 5,727 ft. Water levels at BMW-1 show a net decline during the 2-year period prior to infiltration at the RIB in 1996. The declines have continued through 2005, and since then have remained relatively stable between 5,720 and 5,723 ft amsl. To summarize, the 45-foot "mound" perceived by GBRW because of infiltration at the RIB is non-existent.*

GBRW Comment #14: "WMC claims the model is relatively well calibrated"… "[I]f the recharge rate is actually over-predicted because they [WMC] ignored seasonal changes (WMC, 2005, Page 7), [then] the model is poorly calibrated because the well observations would reflect these seasonal changes".

NDEP Response*: A review of groundwater elevation data since 1994 for the monitoring wells closest to the RIB (e.g. BMW-1, MW-109, MW-110, MW-111 and MW-112) show seasonal elevation fluctuations of less than a few feet, with water levels rising and falling simultaneously at each of the monitoring sites and maintaining the overall groundwater gradient. Since the impact of the seasonal fluctuations is almost negligible, it is safe to conclude that the WMC model was correctly calibrated.*

GBRW Comment #15: "The [groundwater] model as presented by WMC is based on too many assumptions and an inappropriate and potentially incorrect conceptual model for flow from the RIB into the primary groundwater aquifer layers. The model is not calibrated to data but rather refers to data from other mines and areas, without reference, for setting model parameters. WMC also present[s] results in a biased way by considering only layer 9 which would have lower concentrations whether confined, due to upper layers intercepting and advecting [sic] the flow laterally, or due to the mound saturating overlying layers which would suffer the increased concentrations."…"NDEP should not base any decision on this [groundwater] model without obtaining additional data and better presentation of the model results."

NDEP Response*: The MODFLOW-SURFACT model is one of many mathematical models used for* *predictive groundwater modeling. There is no one perfect model; there will always be deficiencies or flaws regardless of the validity of the data inputted or the assumptions made by the modeler.*

While it is always easier to suggest that facilities perform additional monitoring and collect more data, the question of "how much more data is needed and how much longer does it need to be collected?" arises. Eventually a decision has to be made based on the most current and relevant information available and best professional judgment. Predictive modeling is a useful and practical tool to aid in decision making, but it is not the only tool.

WMC's initial modeling results (submitted to NDEP in August 2005), estimated several critical input parameters, but did not fully address the impacts (i.e. leakage) of the RIB conveyance channel and the long-term effects of infiltration on the local groundwater flow direction, elevation and chemistry.

At the request of NDEP, WMC and RMGC addressed these concerns by expanding the monitoring network to include the alluvium along the west wall of the pit, the conveyance channel and the zone outside the RIB to collect additional data. Newly generated stratigraphic, groundwater elevation and water chemistry data was incorporated into subsequent model runs (June 2006, July 2006, October 2006 and January 2007) as the data became available. This continued refinement of the modeling and recent monitoring data from the weir discharge and monitoring wells near the RIB demonstrate that RIB discharge is not degrading waters of the state at the current discharge rate and will not degrade waters of the state at the projected discharge rate.

The MODFLOW-SURFACT version 2.0 utilized by WMC is a relatively simple model that is based on a limited set of assumptions. None of the model assumptions considered by WMC are unreasonable or suspect:

- *Observed water-levels in monitoring wells represent the overall head field of the groundwater system;*
- *Water infiltrates vertically from the RIB through a system of interbedded sand and clay layers;*
- *Ambient groundwater recharge is negligible due to low precipitation and high rates of surface soil and plant evapotranspiration; and*
- *Small-scale parameter differences can be represented with overall "effective" values on the larger scale of the model.*

The conceptual groundwater flow regime simulated by the model is based upon constant head boundaries that WMC believes are reasonably constrained by the available head data. The boundaries have been located at a sufficient distance from the RIB so as to not over-constrain the model solution. The location of the RIB and surrounding monitoring wells and piezometers, are well documented, and have been accurately incorporated in the model. Infiltration rates from the RIB have been accurately estimated and incorporated over time. Assigned hydraulic conductivities are reasonable given the available data and setting. The simulated water-table reasonably matches the observed water table. The model also does not show a 45-foot mound at the site, as interpreted by GBRW from an erroneous data point.

Some uncertainty in groundwater parameters (i.e. groundwater conductivity, etc.) exist in any model. The parameters selected for the current model are not unreasonable, and were selected based upon WMC's experience at the site. If the selected parameters are higher than those in the *actual systems, then the constituent transport simulations are quite conservative with respect to advective transport. This is because the actual groundwater velocities would be less than simulated groundwater velocities.*

WMC selected Layer 9 for presentation of the modeling results because it represents the overall concentrations simulated by the model in the saturated zone. Layer 9 was also selected for the sake of simplicity in presenting results. Multiple layers showing approximately the same concentrations were not considered necessary as part of the scope of the technical memorandum. Note that due to the drop in heads to the north, only layers 7 through 11 remain saturated throughout the domain of the model. Horizontal flow rates in unsaturated regions of the vadose zone were simulated as negligible by the model. This is consistent with the accepted understanding that water flow in the vadose zone is primarily vertical, with some lateral spreading, while flow in the saturated zone is typically horizontal.